Status of the HIRDLS HNO_3 Data Product

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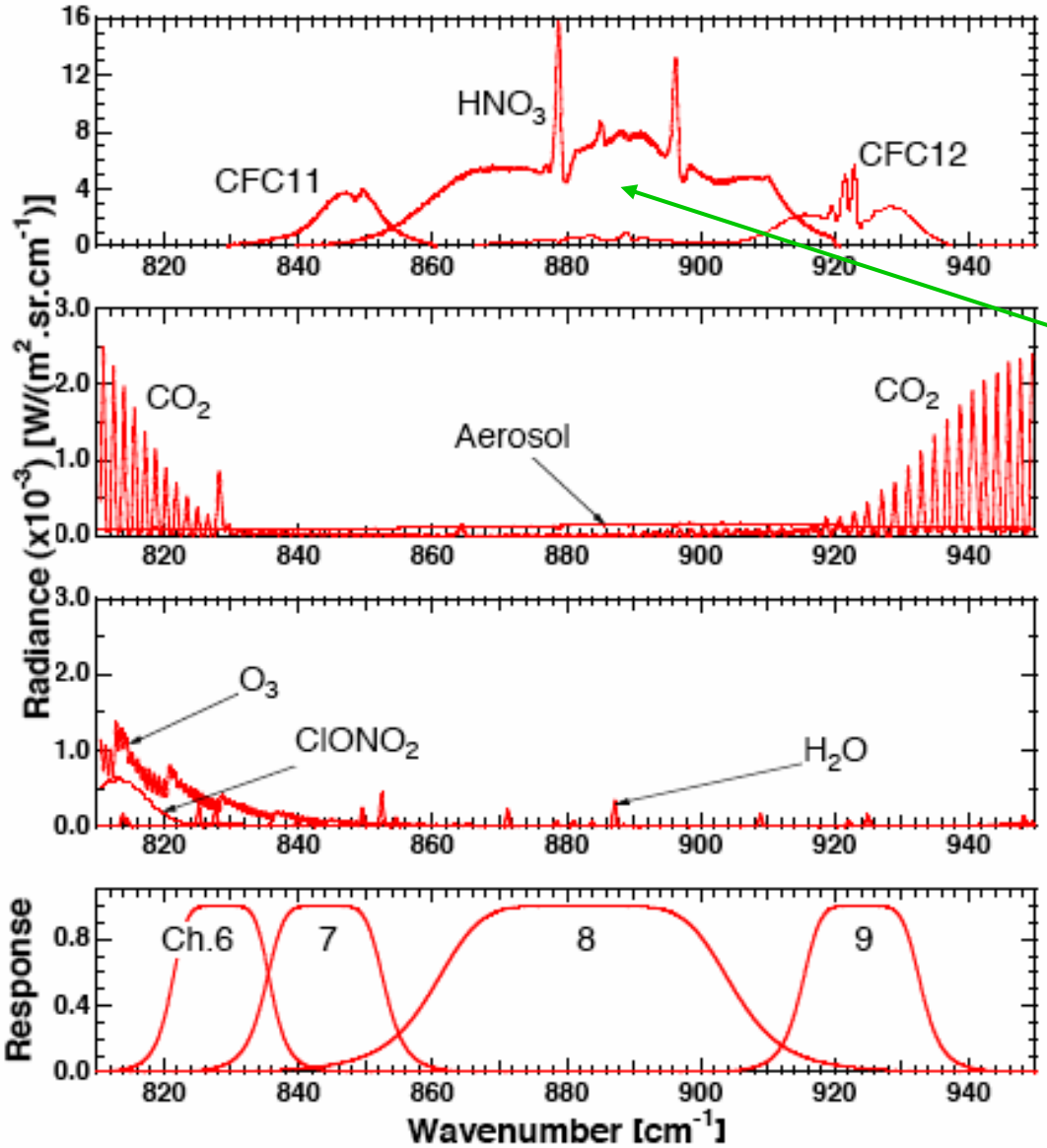
+ MLS Science Team

+ ACE Science Team

Aura Science Team Meeting

Nederlands, 2005

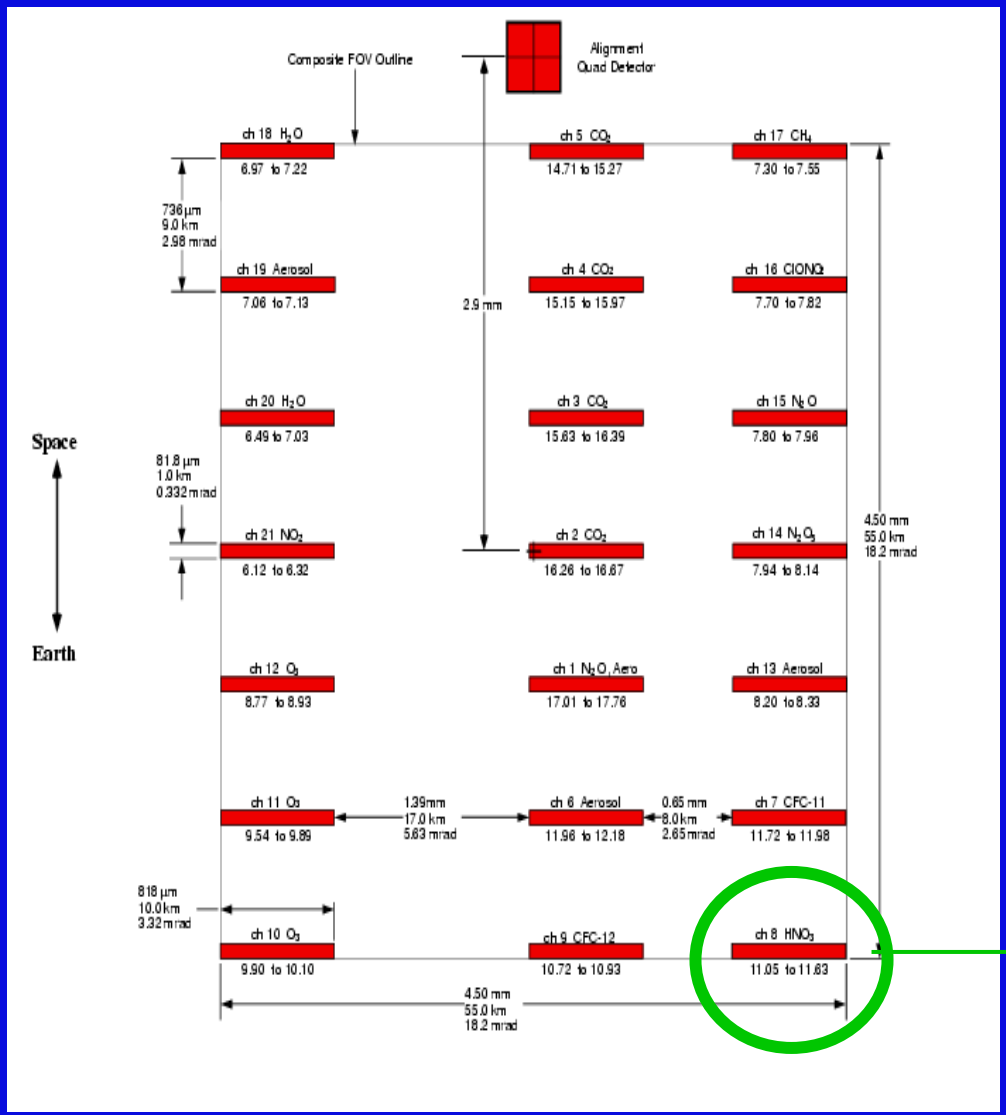
Limb Radiance Spectra for HIRDLS channels 6-9 for a Tangent Height of 25km

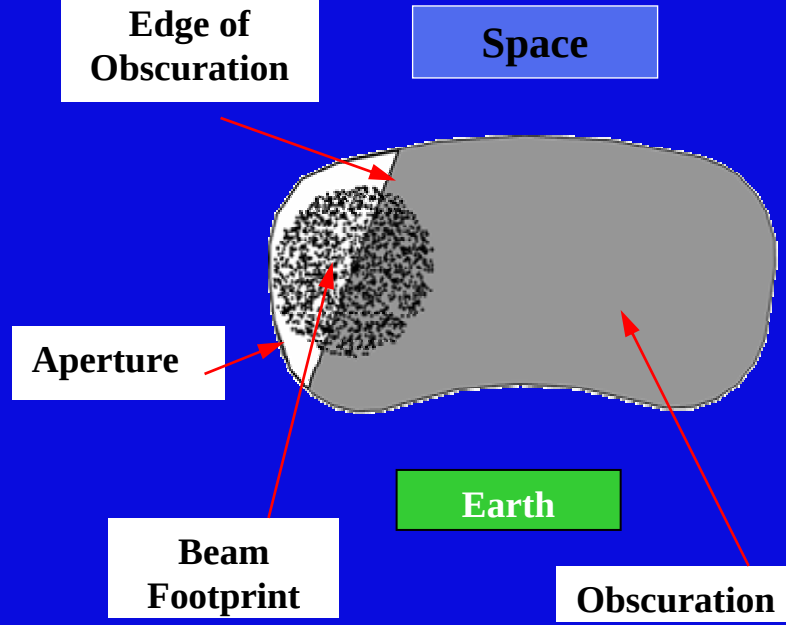


Edwards et al., Appl. Optics, 1995.

HNO_3 has a strong radiance signal in channel 8 between 861-903 cm^{-1}

HIRDLS Field of View Map



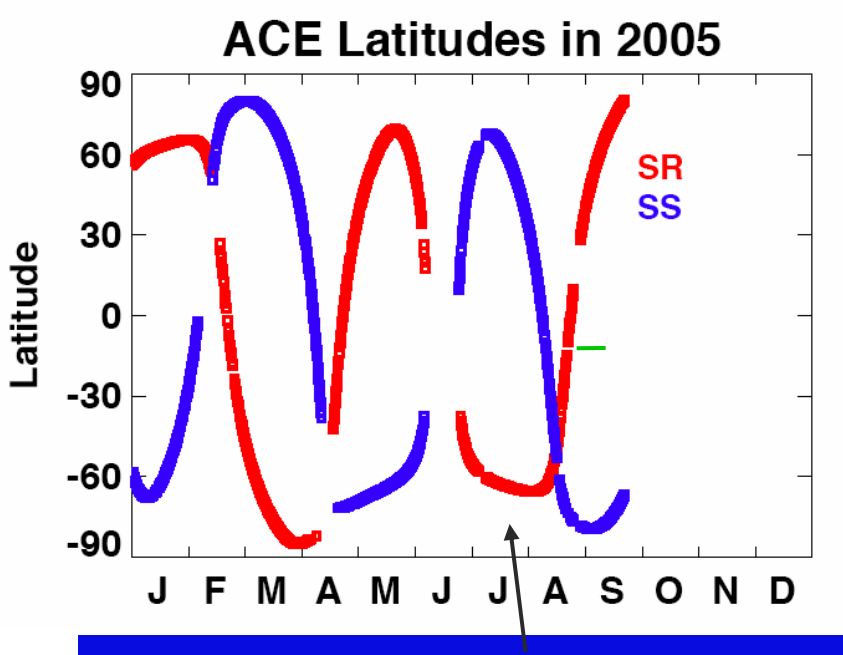


HNO_3 Channel 8 position on the detector array is NOT optimal.

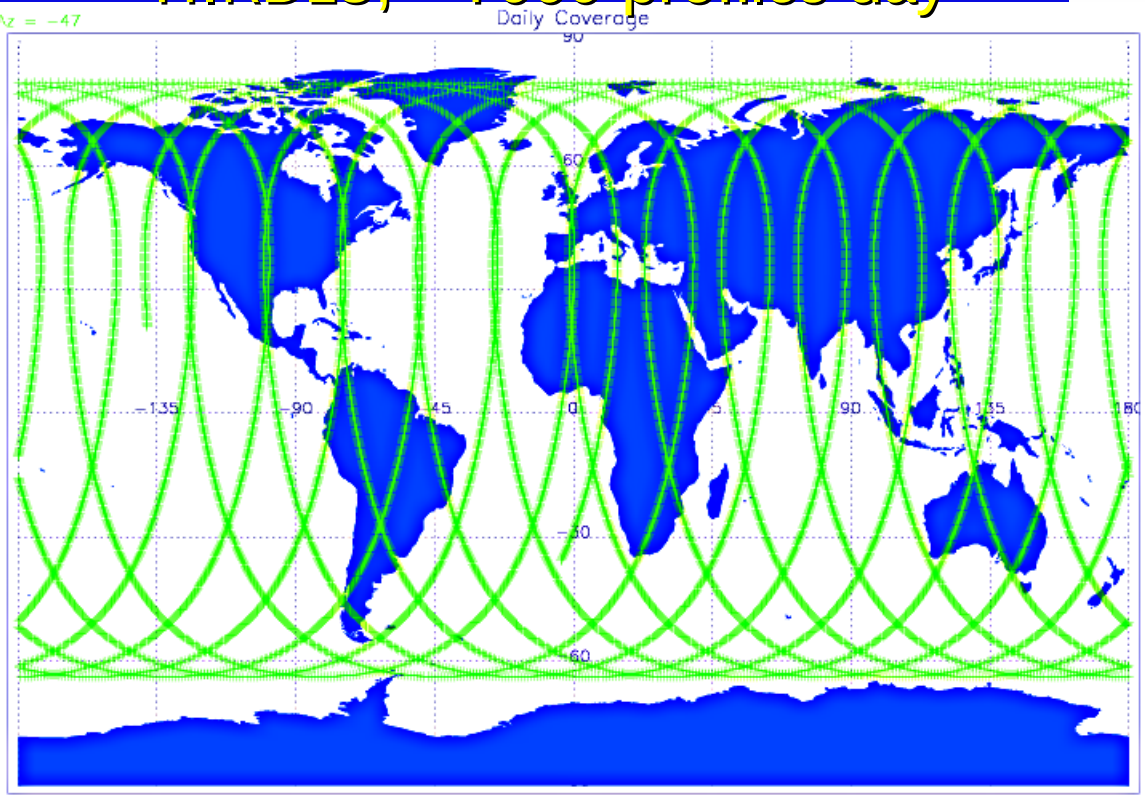
Presentation Outline

- Profile Comparisons
  - Highlight biases
    - Validate with ACE data
- Global Features
  - Does HIRDLS represent know climatologies?
    - Compare with LIMS and Aura MLS data.
- Cold T's, PSC's
  - Does HIRDLS see NH de-nitrification

Comparison of orbit tracks between Atmospheric Chemistry Experiment (ACE) and HIRDLS



HIRDLS; ~7000 profiles day^{-1}



80°N

30 profiles day^{-1}

64°S

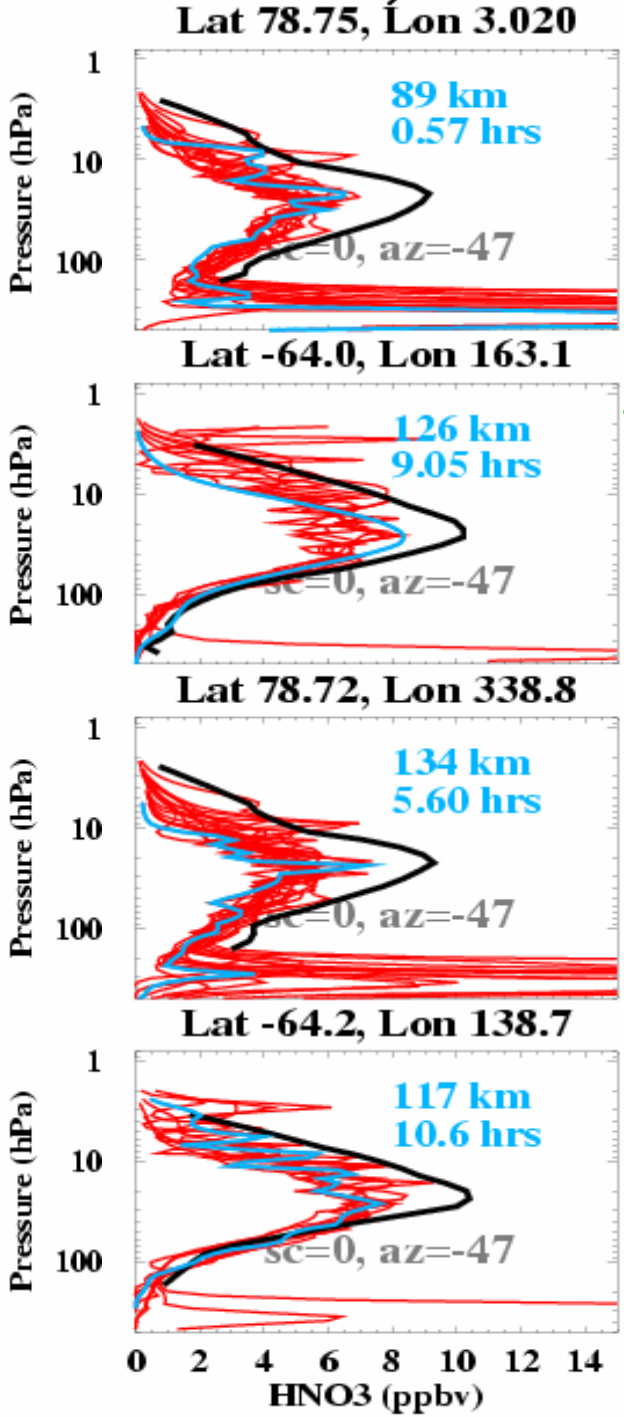
Comparison with Atmospheric Chemistry Experiment (ACE)

Coincidence criteria: 500 km, 12 hours

The coincidences were as follows (approximate ACE latitudes):

1) 20050127:	7 coincidences, ~65N,	5 coincidences, ~40S
2) 20050207:	8 coincidences, ~63N	
3) 20050309:	14 coincidences, ~79N,	12 coincidences, ~63S
4) 20050316:	12 coincidences, ~73N	
5) 20050322:	9 coincidences, ~65N	
6) 20050511:	12 coincidences, ~59N,	14 coincidences, ~66S
7) 20050721:	13 coincidences, ~59N,	12 coincidences, ~64S

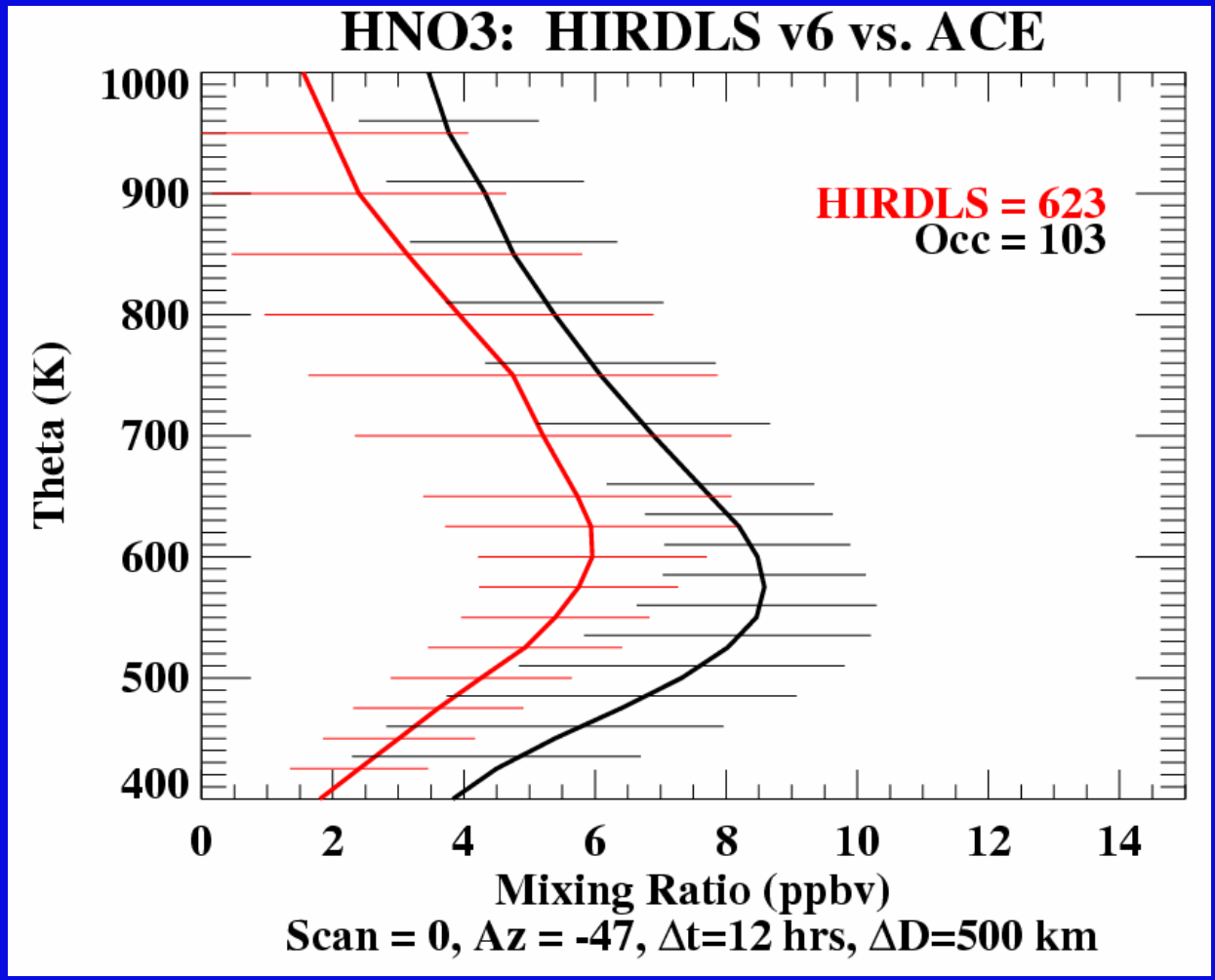
For this study we have 103 coincidences total.



Comparison with ACE, March 9, 2005

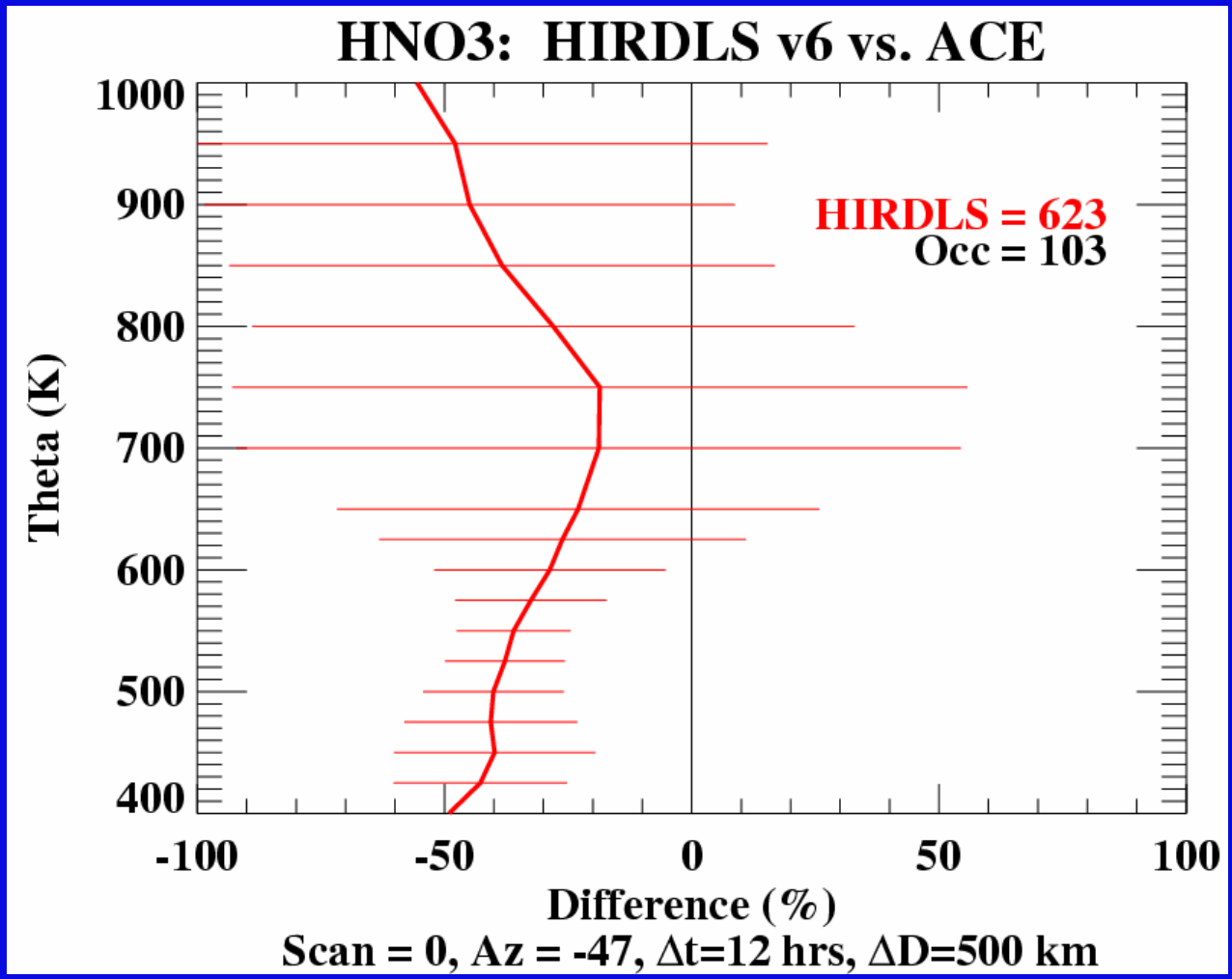
- Red: all profiles within 500km and 12-hours
- Blue: Closest profile to ACE
- Black: ACE profiles

- HIRDLS is biased low relative to ACE.
- Clouds can be seen below 100hPa
- More structure in the “closet profile” relative to ACE.



HIRDLS is biased low relative to ACE by 2-3 ppbv.

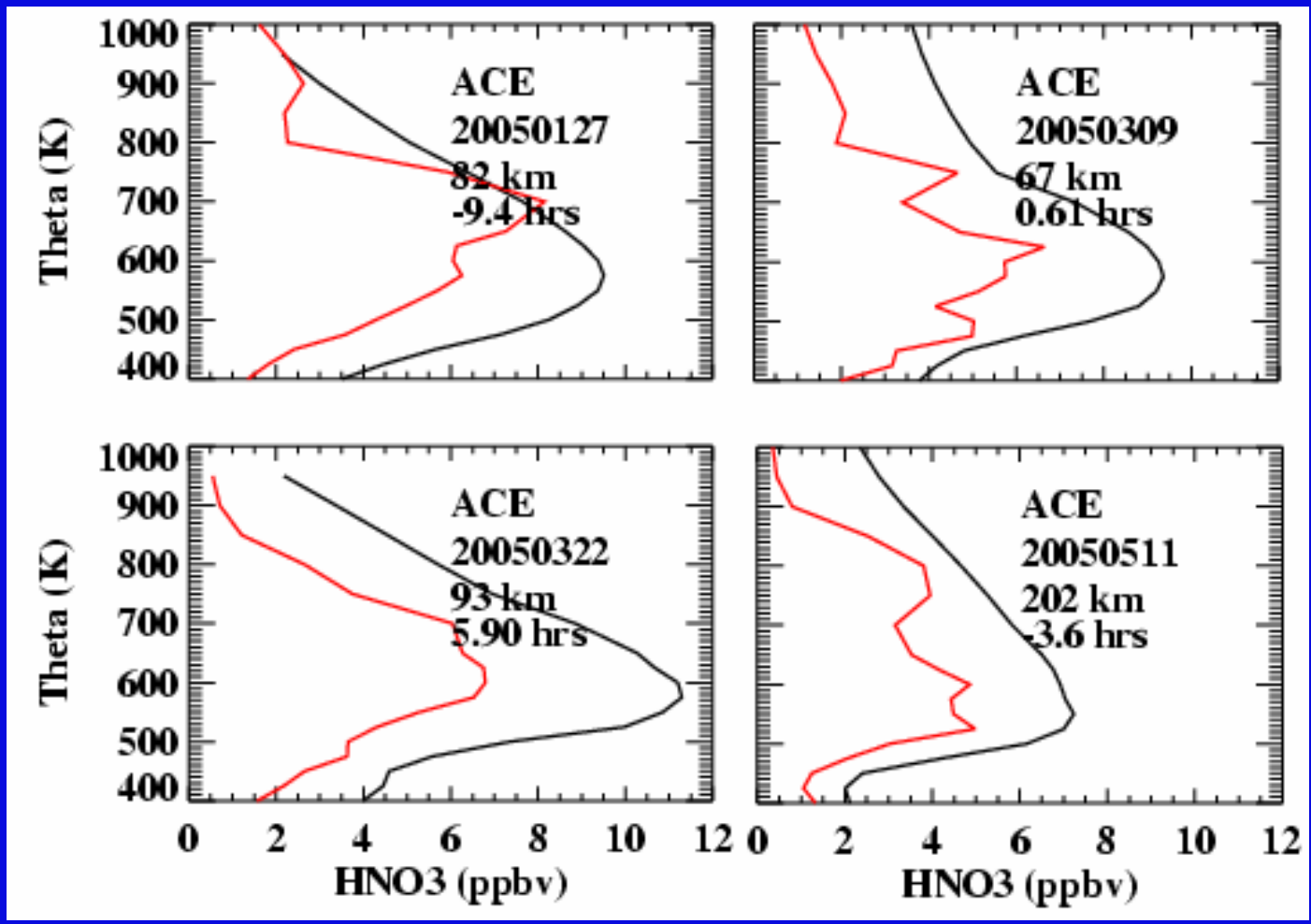
Average HNO_3 profiles from HIRDLS and ACE for coincident measurements on the 7 dates listed previously. Error bars denote 1-σ standard deviation of the distributions.



HIRDLS is biased low relative to ACE by 20-50%.

Average differences between HNO_3 profiles from HIRDLS and ACE for coincident measurements on the dates listed on the first slide. Error bars denote 1-σ standard deviation of the distributions.

Structure in HIRDLS is not seen in ACE.



This shows the closest (in space) HIRDLS and ACE coincidences on each of the HIRDLS retrieval dates.

Presentation Outline

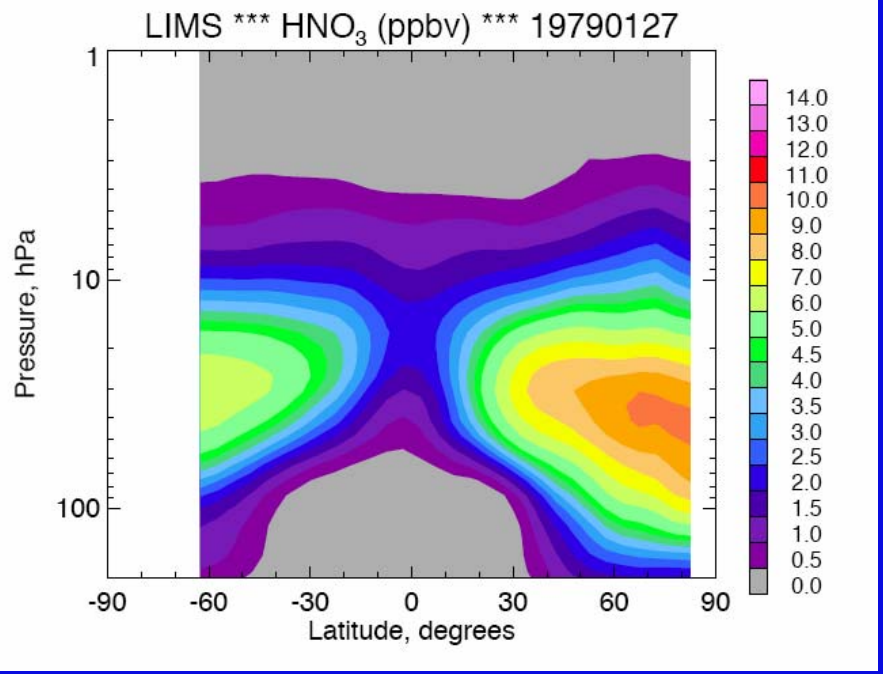
- Profile Comparisons
  - Highlight biases
    - Validate with ACE data

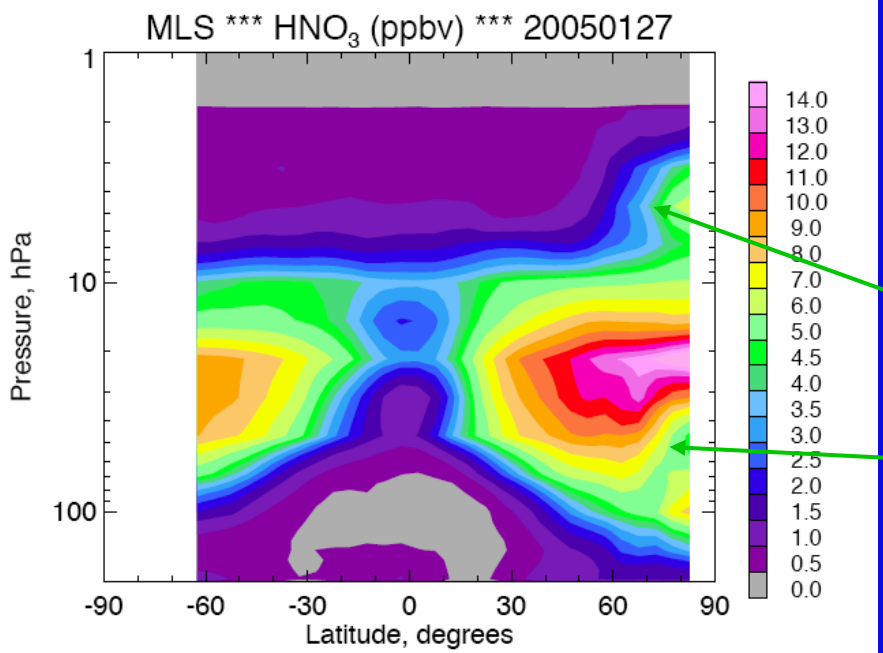
- Global Features
  - Does HIRDLS represent know climatologies?
    - Compare with LIMS and Aura MLS data.
    - Correlative data interpolated to HIRDLS track.
    - Binned: 5° latitude and 20° longitude

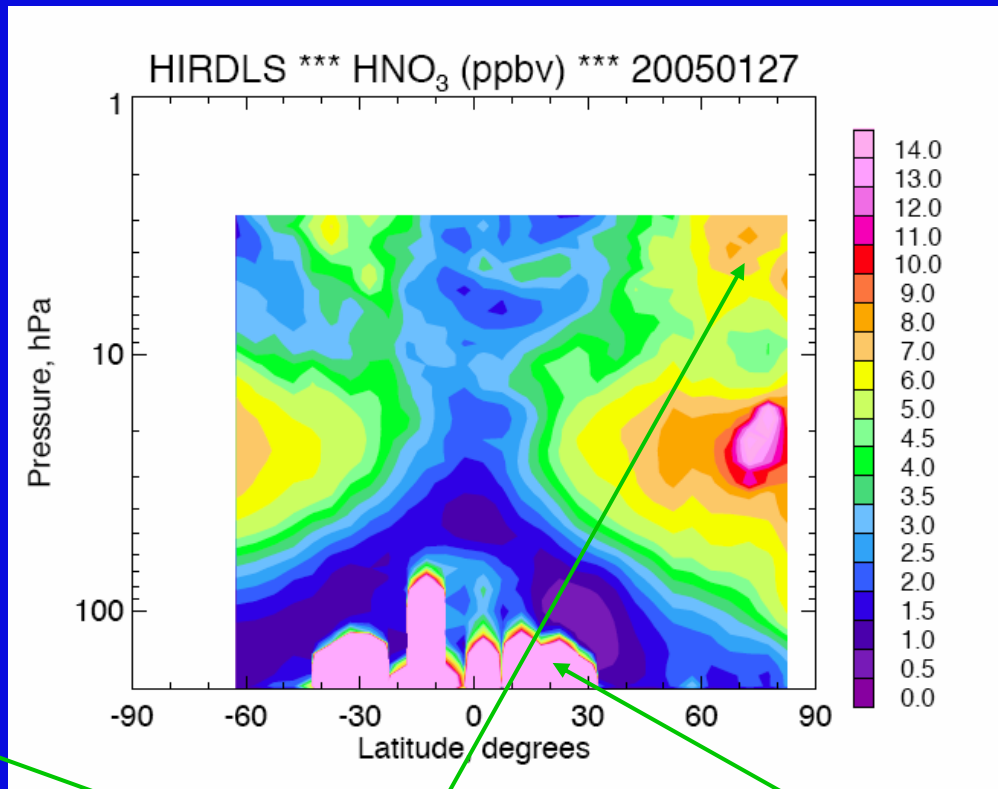
- Cold T's, PSC's
  - Does HIRDLS see NH de-nitrification

Global Comparisons Jan 27th (1979; 2005)

binned: 5° latitude; 20° longitude







Solar Activity

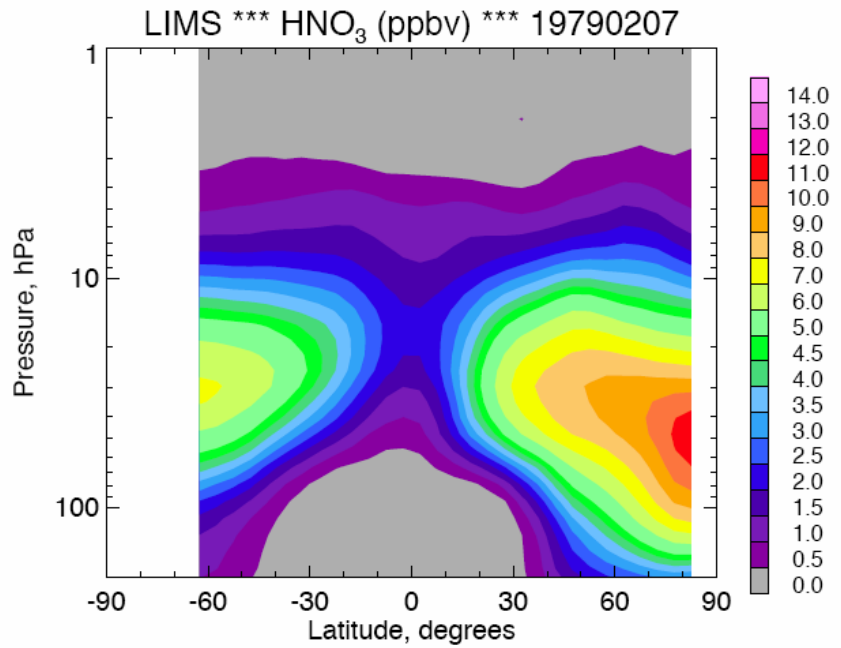
Clouds

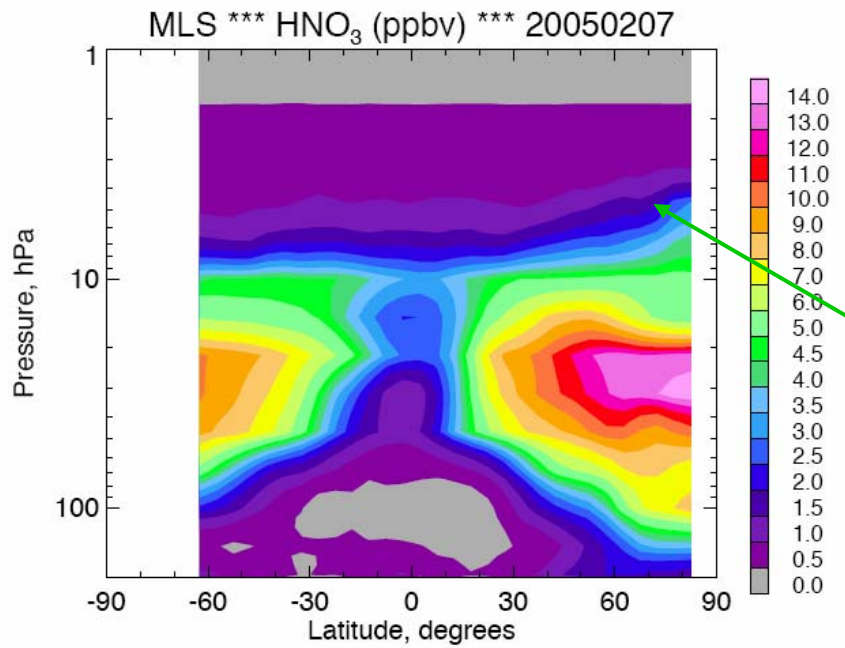
De-NOY in MLS; not in HIRDLS

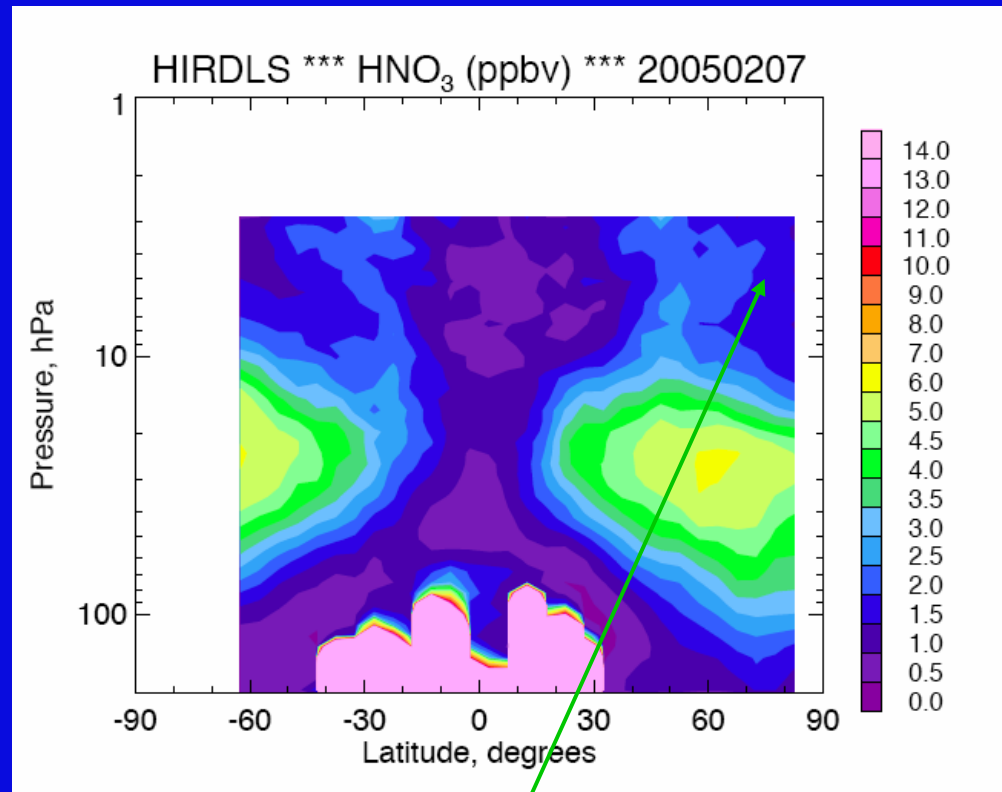
Correct Winter/Summer Asymmetry represented in HIRDLS (more HNO_3 in NH)

Global Comparisons Feb 7th (1979; 2005)

binned: 5° latitude; 20° longitude





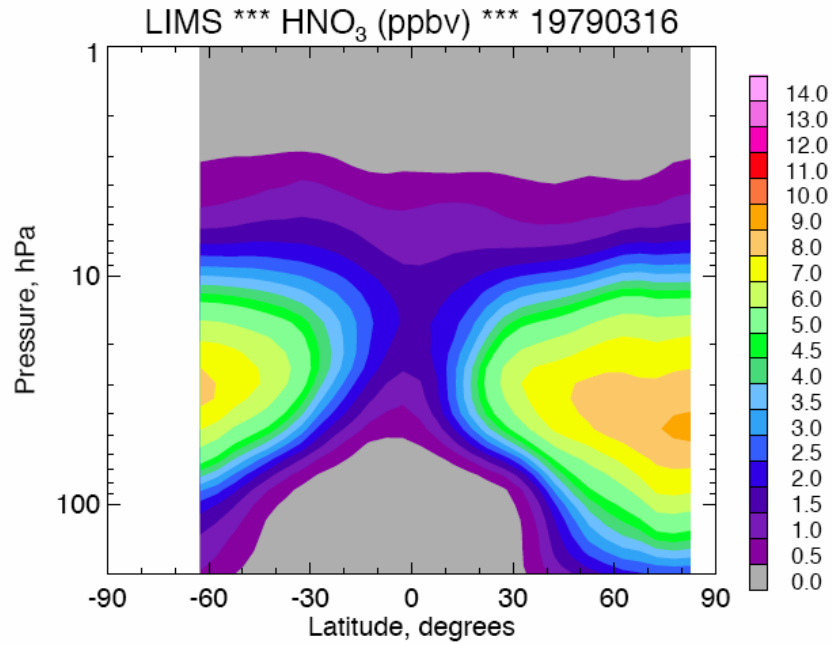


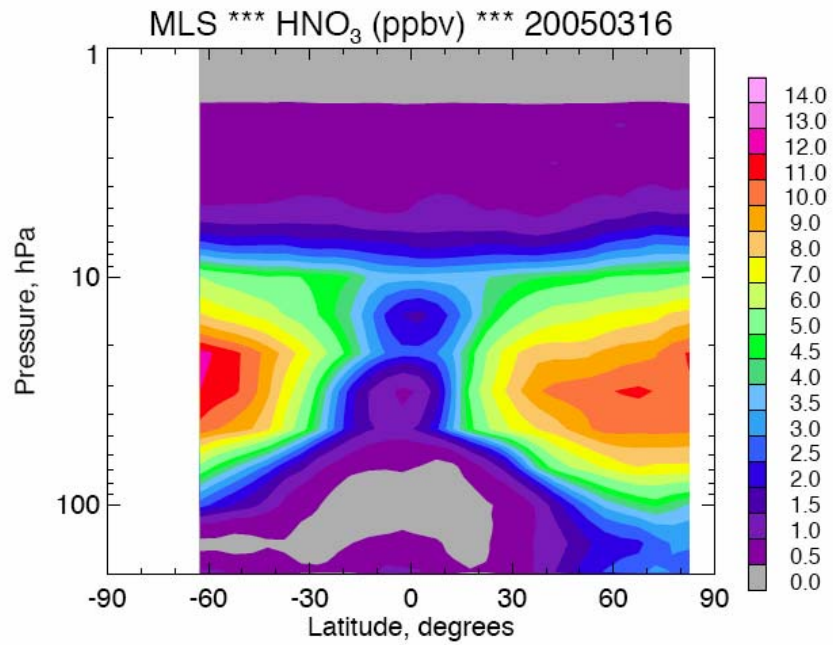
Less Solar Activity Signal

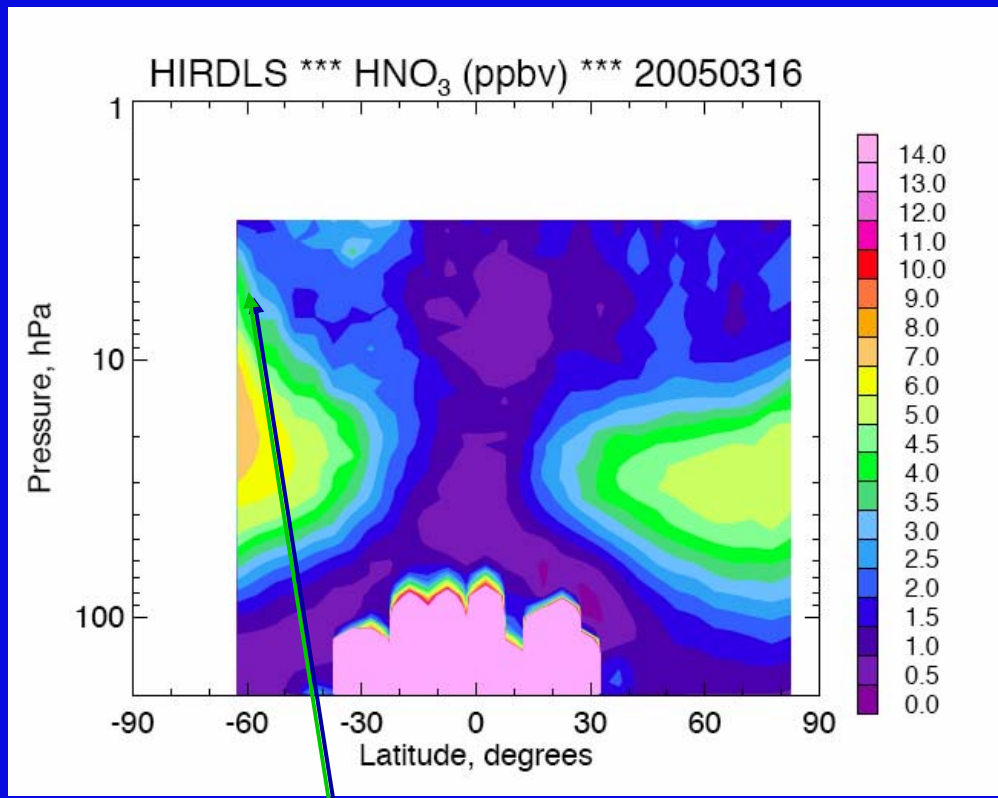
Correct Winter/Summer Asymmetry represented in HIRDLS (more HNO_3 in NH)

Global Comparisons March 16th (1979; 2005)

binned: 5° latitude; 20° longitude





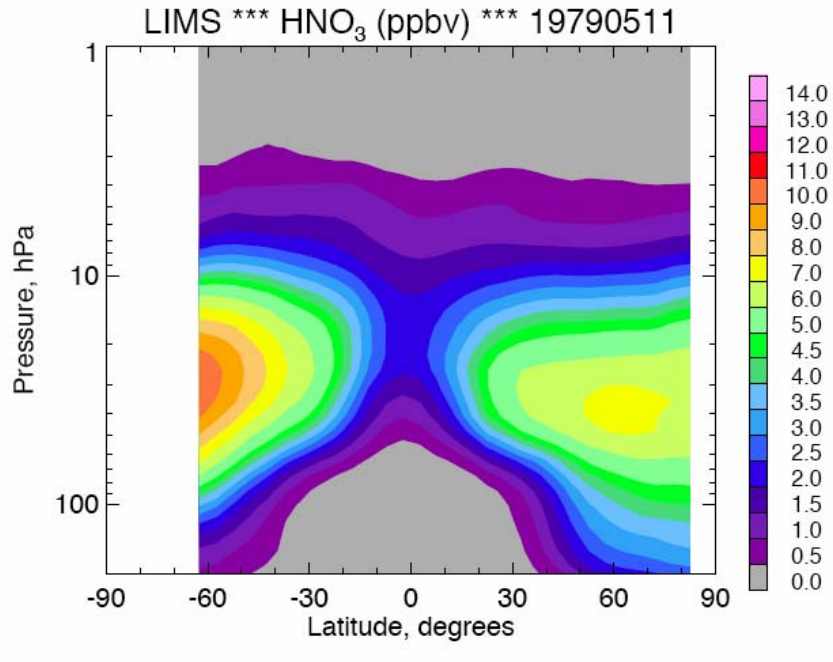


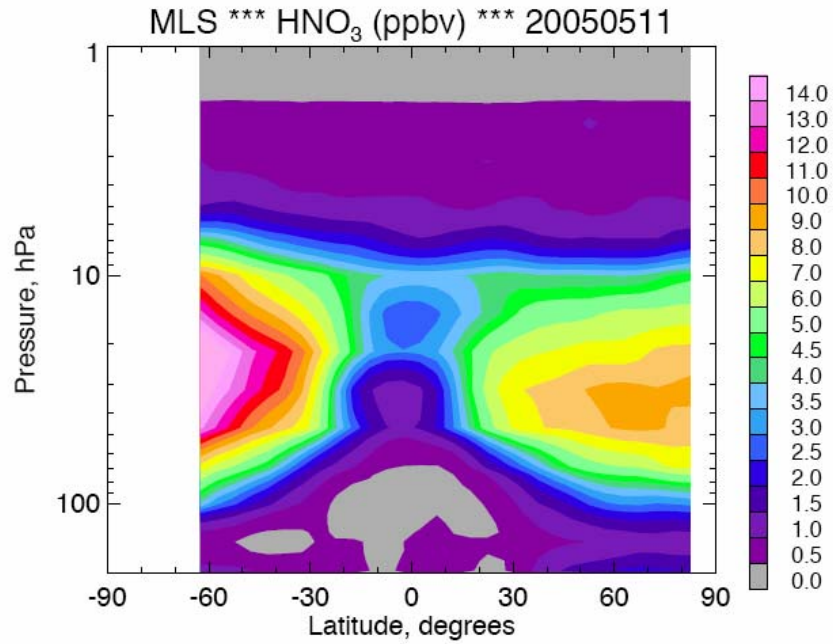
Enhanced HNO_3 not present in MLS

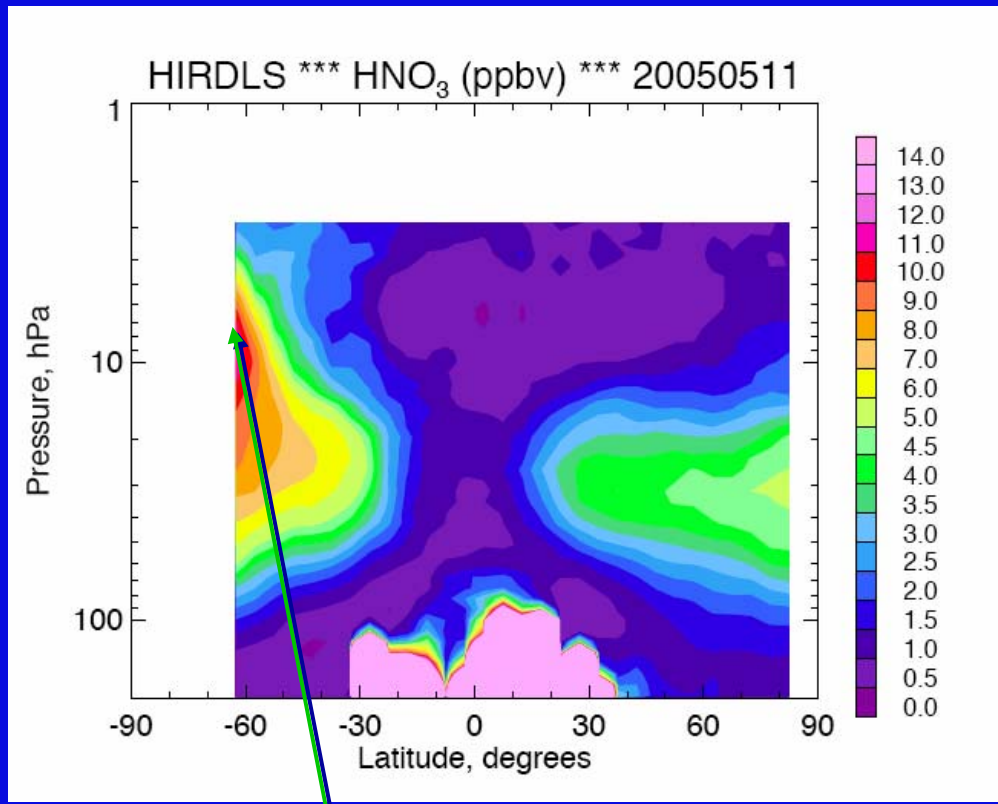
Correct Winter/Summer Asymmetry represented in HIRDLS (approx. equal HNO_3 in NH and SH)

Global Comparisons May 11th (1979; 2005)

binned: 5° latitude; 20° longitude







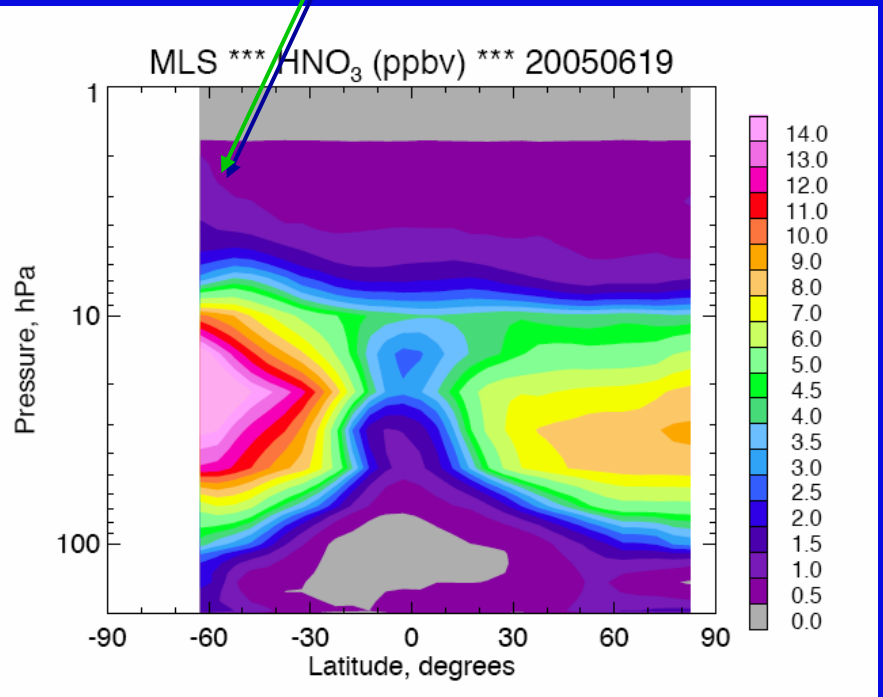
Enhanced HNO_3 not present in MLS

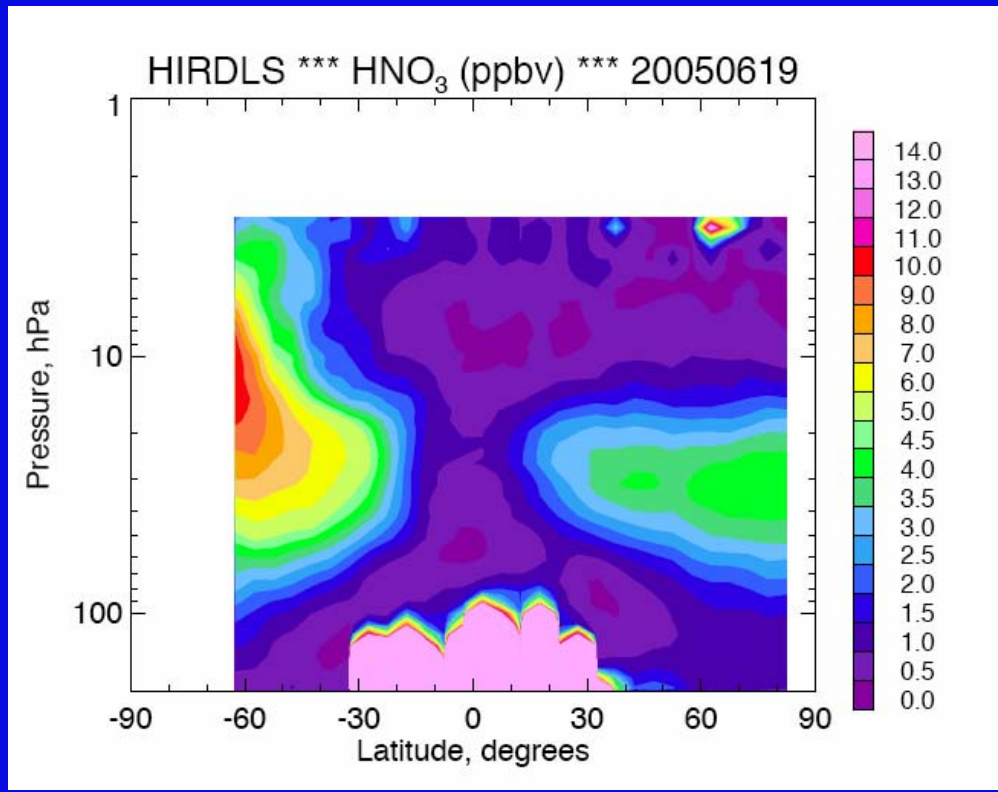
Correct Winter/Summer Asymmetry represented in HIRDLS (more HNO_3 in SH)

Global Comparisons June 19th (2005)

Enhanced HNO_3 beginning to show up in MLS

binned: 5° latitude; 20° longitude



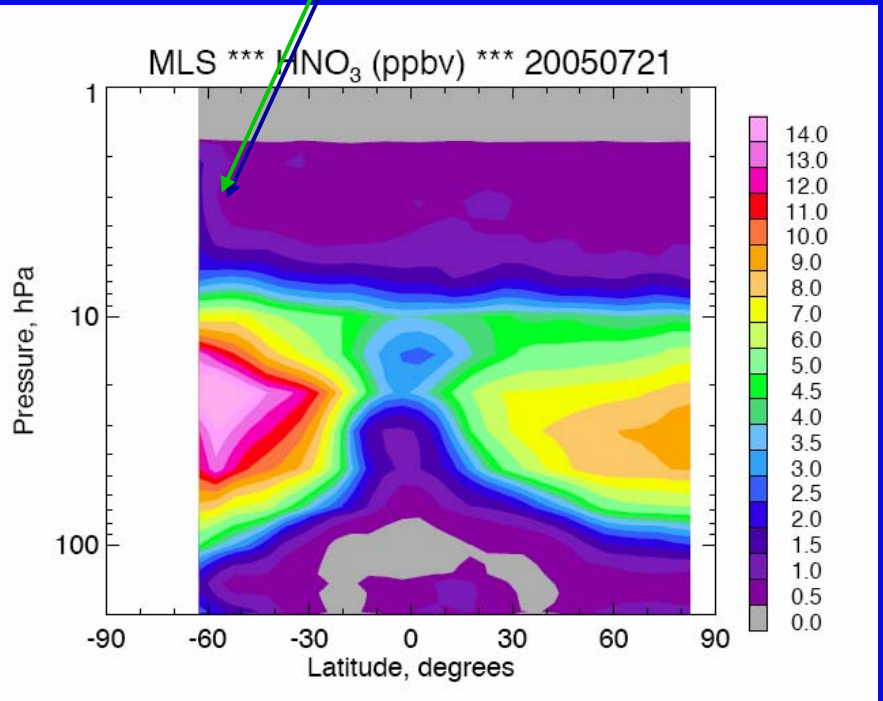


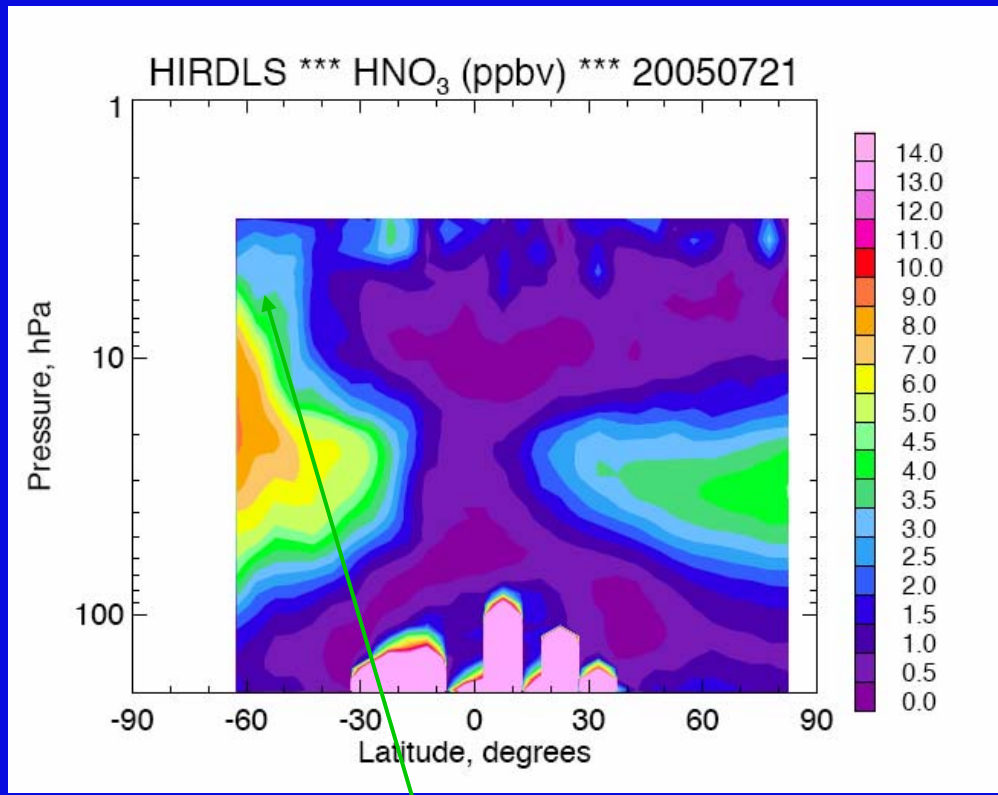
Correct Winter/Summer Asymmetry represented in HIRDLS (more HNO_3 in SH)

Global Comparisons July 21st (2005)

binned: 5° latitude; 20° longitude

More Enhanced HNO_3 in July



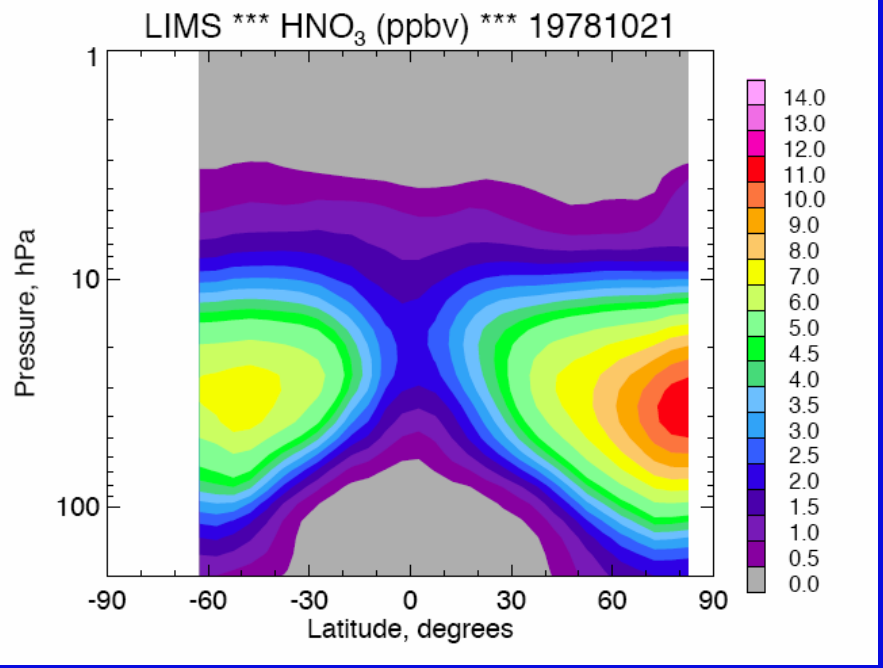


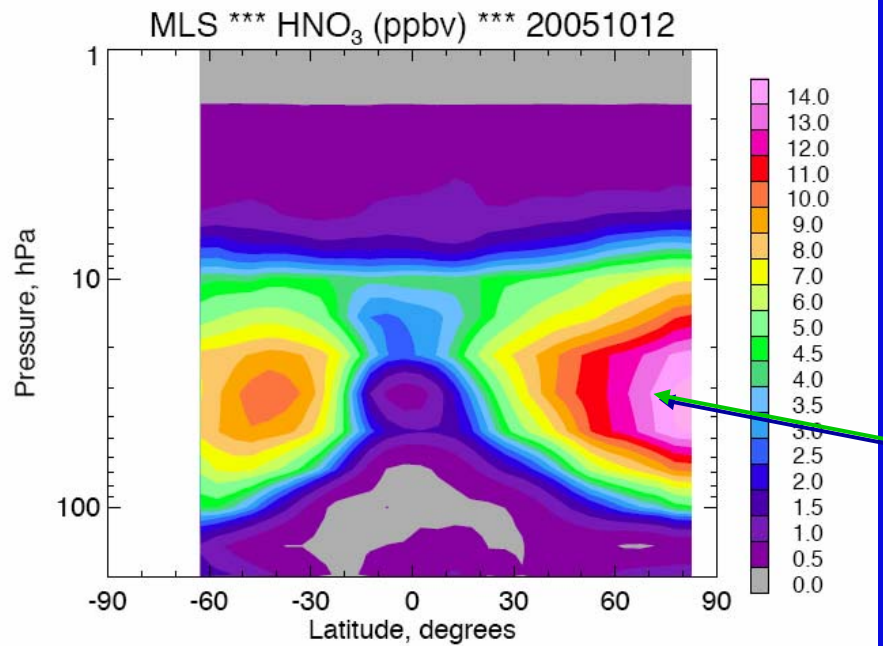
If real; Enhanced HNO_3 signal strong in HIRDLS

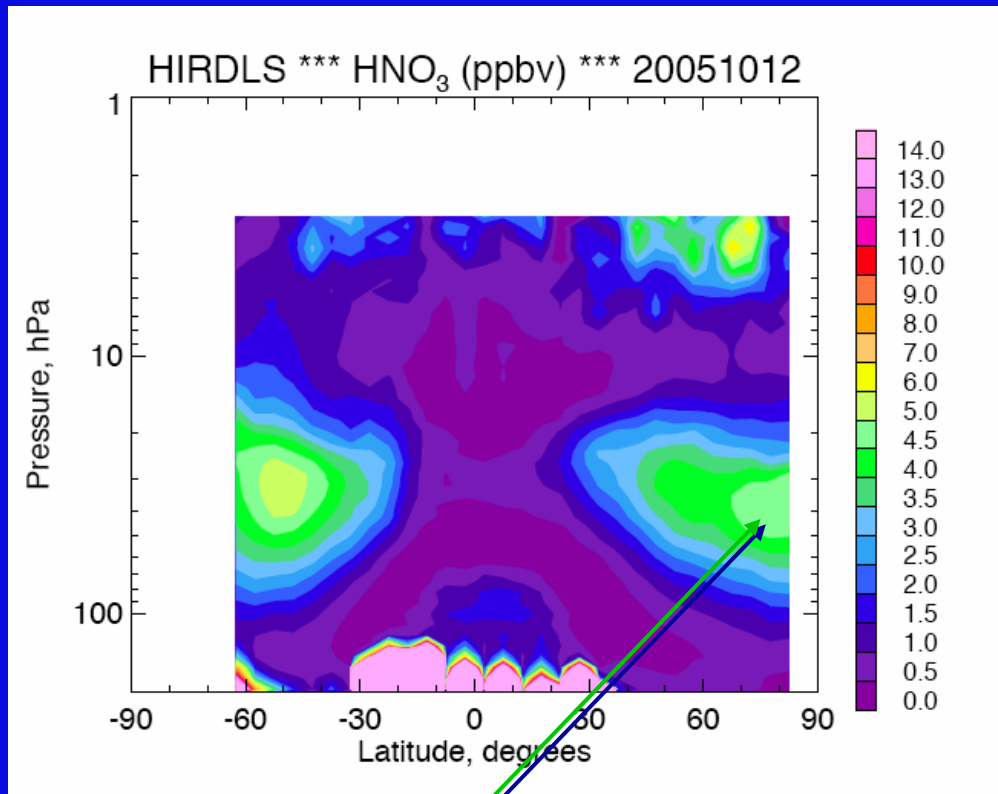
Correct Winter/Summer Asymmetry represented in HIRDLS (more HNO_3 in SH)

Global Comparisons Oct 12th (1979; 2005)

binned: 5° latitude; 20° longitude







More asymmetry in MLS than HIRDLS

Presentation Outline

- Profile Comparisons
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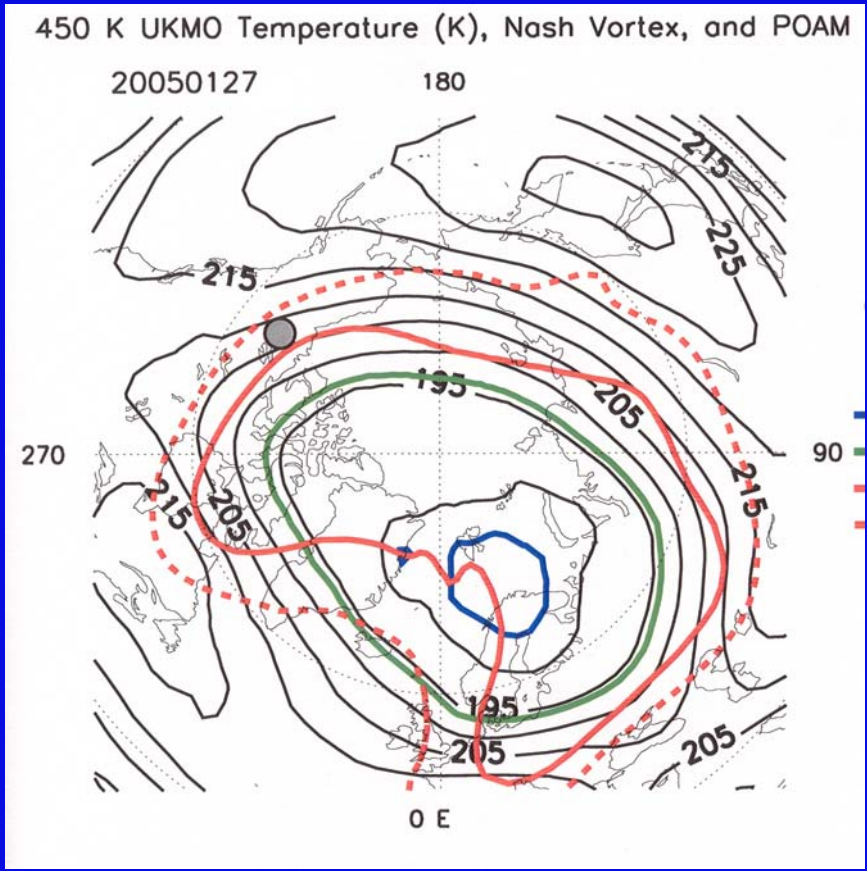
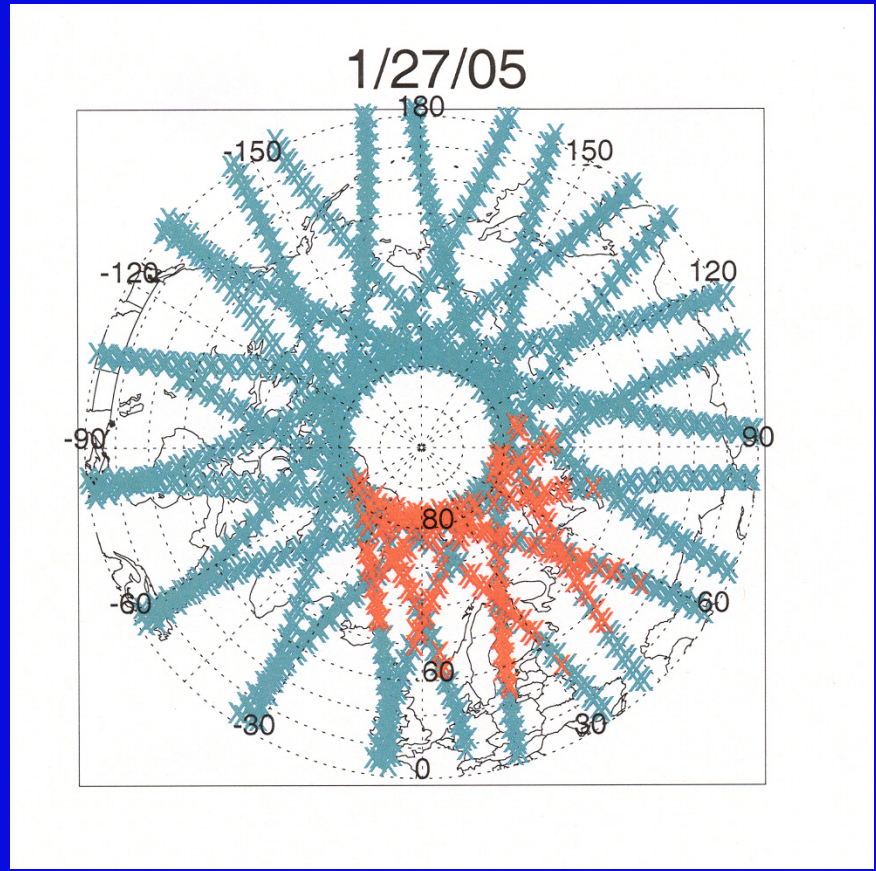
  - Does HIRDLS represent know climatologies?
    - Compare with LIMS and Aura MLS data.
- Cold T's, PSC's
  - Does HIRDLS see NH de-nitrification

HIRDLS PSCs Observed in Cold NH Region

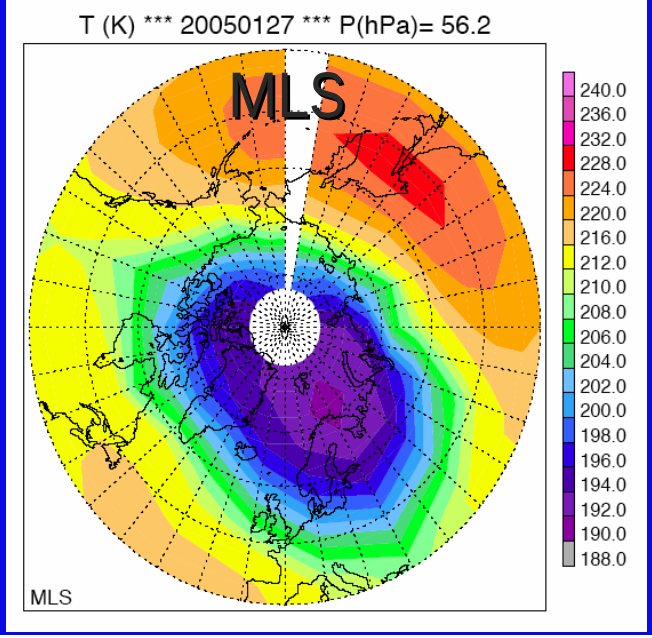


Polar vortex on 27 Jan – courtesy of the POAM group. The green contour marks the region of the 195 K PSC temperature threshold. The blue line marks the ice threshold (for PSC II ice particles). The red lines mark the polar vortex (by the Nash criterion).

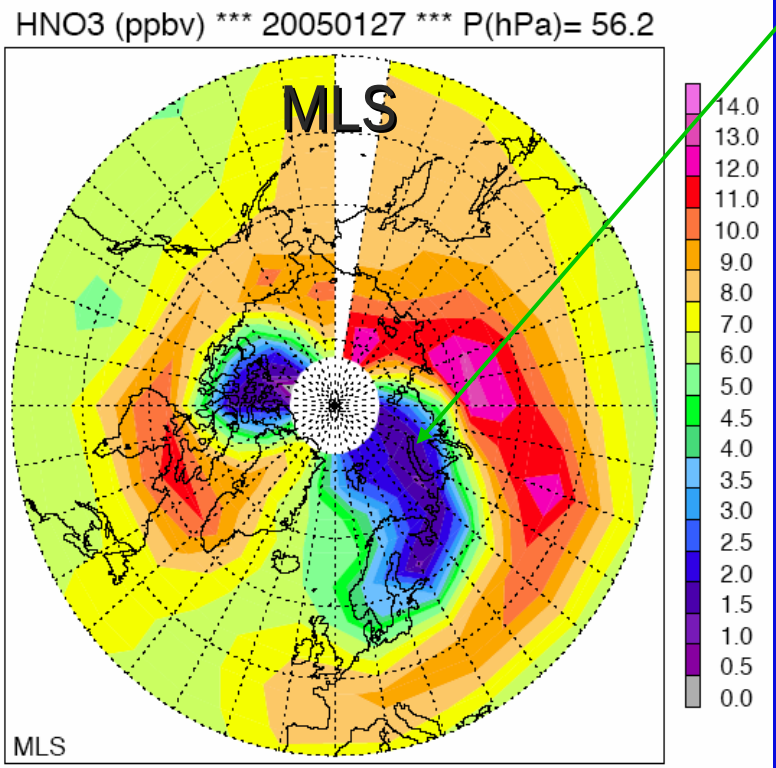


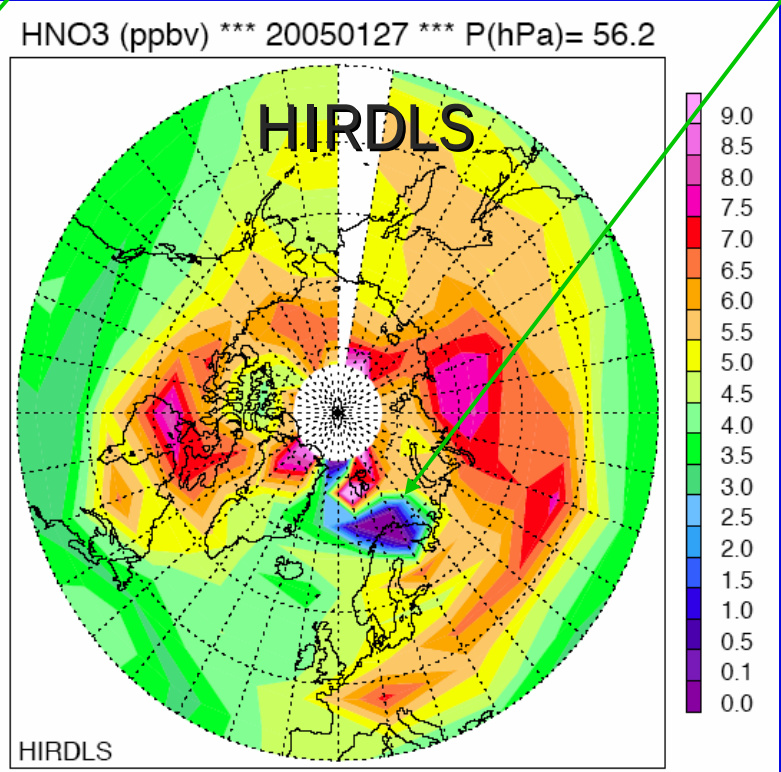
Individual observations of PSCs by HIRDLS 27 Jan 2005. Red crosses are the locations of PSCs (as given by our cloud detection algorithm). Blue crosses are non-cloud observations. By comparing this graph, and the POAM graph, it is apparent that HIRDLS observes many PSC inside the T+195 K temperature contour.

De-nitrification in NH.



HIRDLS does not see the same low HNO_3 values that MLS observes.





Contour intervals adjusted to give same color contrast.

Summary...

- Initial HNO_3 results from HIRDLS look very promising.
- HIRDLS HNO_3 profile comparisons with ACE show HIRDLS is biased low (approximately 3 ppbv at the peak).
- HIRDLS HNO_3 is consistent with the global evolution of HNO_3 relative to LIMS and Aura MLS.
- HIRDLS does not observe extenisive NH de-nitrification (relative to MLS).

The END